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(54) Edge-active transmission belt

(57) A belt 1 comprises a continuous flexible molded body 4,5, wherein a pull strand 2, 3 is embedded. The profile of the belt 1 and its active edges 8, 9 are defined by a series of transverse stiffener elements 6, 7 spaced along the belt 1. The rubberoid material of the belt 1 is molded onto and with surface adherence both to the pull strand 2, 3 and to the transverse elements 4, 5. The belt body 4, 5 runs longitudinally through identical cavities 10, 11 of the transverse elements 6, 7, extending sidewardly at least onto their lateral edges 12, 13 and filling intermediately thereto at least a portion 18, 19, 20 of each space between the sidewalls of the said transverse elements 6, 7. The transverse elements 6, 7 preferably have a ribshaped profile on the contacting surfaces 12, 13 with the molded body 4, 5.

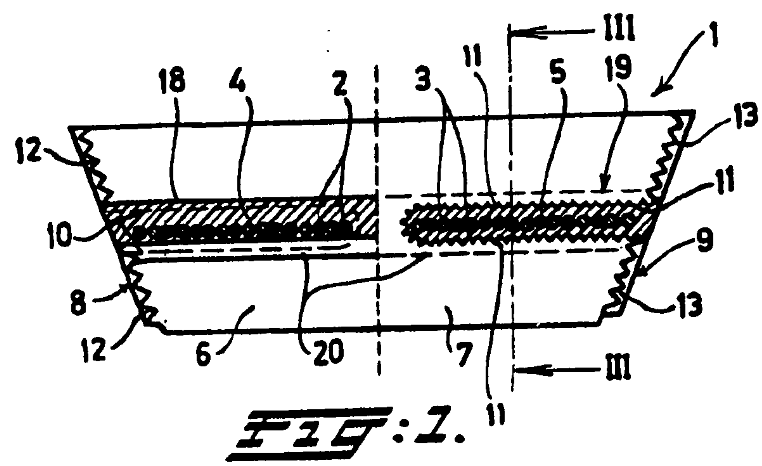

FIG: 1.

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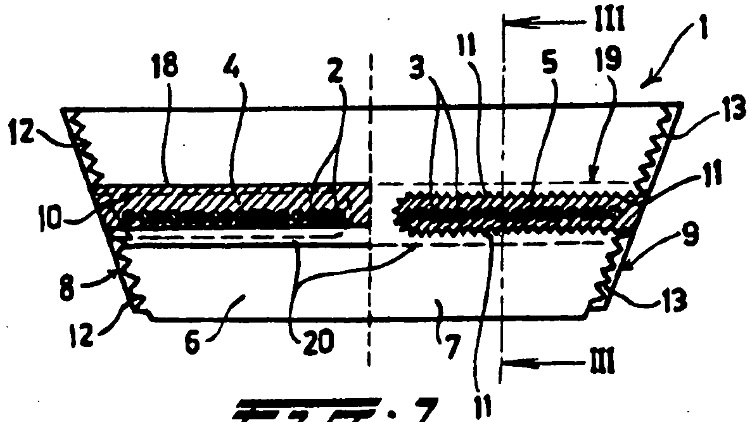

Fig: 1.

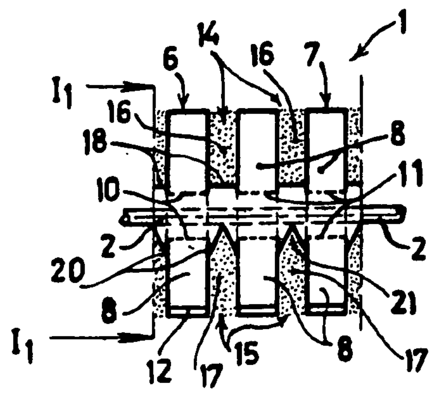

Fig: 2.

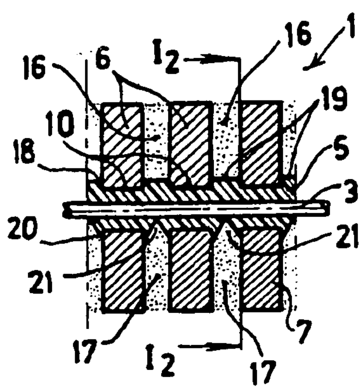

Fig: 3.

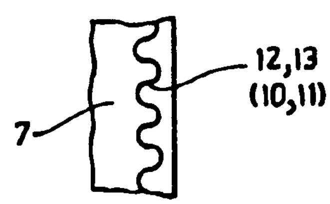

Fig: 4.

SPECIFICATION
Edge active belt

The invention relates to a belt comprising a longitudinal pull strand of high tensile strength and a series of transversely extending longitudinally spaced stiffener elements presenting oppositely facing end surfaces angularly related to a cross-sectional plane of the said belt, the said pull strand being enclosed in a continuous flexible molded body of rubber type material running longitudinally through identical cavities of the said transverse elements which are connected to the said body.

A belt of this type is known from Paul B. Reeves' USA Patent No. 2,638,007. According to this known art the transverse elements are frictionally clamped to a continuous, molded body of rubber or rubberoid material of uniform cross-section by means of a continuous metal clamp strip. The ends of the cross-section of the said strip overhang the lateral edges of the said strand. The band packet formed by the said strand, rubber body and clamp strip runs longitudinally through identical cavities of the said transverse elements. Bolts passed through each of the said overhanging strip ends are screwed into each of the said transverse elements in order to clamp the same against the said continuous belt body.

The means as described for securing the transverse elements to the strands give rise to obvious complications both in the manufacture and in the use of such belts because of the use of an additional metal clamping strip and the series of screw bolts to be provided for obtaining the desired clamping result.

It includes the risk of the loosening of screw bolts during long continued use of the belt.

The present invention is directed primarily to an improved belt construction and particularly to a simplification and improvement of the means for connecting transverse elements to the belt strand.

In this respect it is one object of the invention to shape a belt comprising the aforementioned strand and transverse elements but which is molded as one integral body by which any subsequent mounting of parts is made superfluous.

A method for molding an endless belt having oppositely inclined facing lateral edges is known per se from George E. Green et al. U.S.A. Patent No. 4,000,240.

It is a further object of the invention to shape and arrange the parts of the integral body in a way so as to make sure that the transverse elements are engaged by the rubber or rubberoid material of the continuous molded body along a sufficient large portion of their surfaces to ensure a safe securance of these elements in the molded body during a very long range of use.

It is still another object of the invention to split up the pull strand in two longitudinal sections in one plane each molded by the intermediary of a said continuous, flexible body inside one of two series of identical inwardly extending opposite sideward slots of the transverse elements thus shaping thereby large engaging surfaces on the upper and lower side of each slot.

The invention and features of favourable embodiments thereof will become apparent from the following detailed description at the hand of the accompanying drawings, in which:

Figure 1 represents a side view on two cross sections of a belt constructed according to the present invention, at the left hand side taken along the line I_1—I_1 of figure 2 and at the right hand side along the line I_2—I_2 of figure 3, and viewed in the direction of the arrows on the said lines;

Figure 2 is a fragmental side view of the belt;

Figure 3 is a fragmental cross section taken along the line III—III of figure 1, and

Figure 4 is a side view of a detail of a transverse element.

In the figures the edge active belt as a whole is designated by 1. The pull strand is composed of two groups of cords 2, 3 having high tensile strength in one common plane in the neutral zone of the belt 1 and embedded in the elastic mass 4, 5 thereof. The cords 2, 3 take the pull forces and each cord may be made of twined steel wire or other material of high tensile strength such as synthetic wire with high resistance against stretch. The molded body 4, 5 may be made of rubber or rubberoid material. The term "rubberoid" includes synthetic material for example of a polyurethane composition. The belt body 4, 5 continues together with the strands 2, 3 flexibly along the whole length of the belt.

The profile of the belt 1 and its engaging edges are defined by a series of transverse elements 6, 7 spaced along the whole length of the belt 1. The belt material 4, 5 is connected by surface adherence not only to the surface of the cords 2, 3, but also to surfaces of the transverse members 6, 7. This adherence can be obtained by vulcanisation of the mass 4, 5. When it consists of rubber the vulcanisation period will be about three hours. It has been found that a good adherence is obtained with transfer elements 6, 7 cut from aluminium plate which may have a thickness of about 3 mm. In this case for an endless belt having a length of 400 mm the distance between the plates 4, 5 will be slightly smaller than their diameter. In any case the plates should not touch each other at their inside edges when the belt runs along the curve of the smallest disc diameter for practical use of the belt. It can be calculated that with a smallest travelling diameter rmin, plate thickness *d* and a height 2*h* of the plates their spacing *s* should be:

$$s \geq \frac{hd}{rmin - h}$$

Taking this limit into account the highest possible number of transverse elements is applied in order to obtain a maximum contact for transmission of power between the belt and its

runner discs. In practical application the end surfaces 8, 9 of the elements 6, 7 provide e.g. for active engagement with coned sheaves of a power transmitter in infinitely variable wedge belt drives, at the same time shaping transverse stiffening members for the composite of the belt strand 2, 3 and the flexible body 4, 5, in order to absorb the compressive stress which would otherwise be placed directly by the coned sheaves on the said flexible body.

In the preferred embodiment as shown each of the flexible belt portions 4, 5 is molded inside one of two series of identical, inwardly extending, opposite sideward slots 10, 11 provided in each of the stiffener elements 6, 7. In this way large engaging surfaces between the elastic bodies 4, 5 and the upper and lower surfaces of the said slots 10, 11 are shaped. Moreover these adhering surfaces are enlarged as shown in the right hand part of Figure 1 by providing them with a profilation in the shape of ribs running transversely to the main surface of the plates 6, 7. Therefore they can be obtained by a corresponding shape of a cutting edge in one and the same cutting operation by which each plate is separated from a metal plate or strip. When molding the bodies 4, 5 integrally with the metal parts 2, 6, 7 in a die, space can be spared therein on both sides of the opposite faces 12, 13 of the elements 6, 7 so that the mass of the flexible bodies 4, 5 is sidewardly continued outside of the surfaces 12, 13 in the shape of friction pads 8, 9 on the said surfaces, which are also profiled for enlarging the surface of adherence in the same way as indicated for the surfaces 10, 11.

Thus the friction pads 8, 9 will form one integral unit with the bodies 4, 5 which brings the advantage of increased strength and simple manufacture.

Figure 4 shows a shape of a profilation as it may be used for practical purposes instead of a saw-tooth profilation as shown in the other figures.

It can also be seen in the figures, that the material of the elastic bodies 4, 5 for obtaining a still larger engaging surface with the stiffener members 6, 7 and for securing the spacing of these members enters above and below the strands 2 and 3 into the space between the elements 6, 7 as designated at 18, 19 and 20, adhering to at least a portion of the side walls of the said elements 6, 7 along and beyond the edges of the cavities 10, 11. This enclosure of the transverse elements in the longitudinal direction of the belt 1 has also importance for preventing the occurrence of tears in the belt material at the edges of the said elements engaging the belt bodies 4, 5.

As designated at 21 in Figures 2 and 3 respectively the flexible molded bodies 4, 5 are indented substantially onto the surface of the pull strands 2, 3 respectively in the middle plane between the adjoining parallel faces of each of two of the stiffener elements 6, 7. This shape is due to the fact that within the mold the strands 2 are to be supported in a circular form upon radial extensions of a central mandrel extending between the stiffener elements which are positioned in the said mold.

Because of the good adherence between the belt material 4, 5 and the transverse elements 6, 7 in the slots 10, 11 and the further measures as above described the forces are transferred very equally and reliably to both the upper and lower surfaces of the cords 2, 3 and it is no longer necessary to use material between those cords for this purpose.

Therefore the present invention brings also the advantage that the cords 2, 3 may be brought close together and a large number of them can be provided within a given width of the belt 1.

The invention allows to provide lightweight belts of relatively small cross section for the transfer of high loads.

In an advantageous embodiment of the invention as shown in Figures 2 and 3 and as designated at 16 and 17 the spaces 14 between the stiffener elements 6, 7 above and below the flexible molded bodies 4, 5 are stuffed with a material which is more easily compressible than that of the said molded material. For this purpose a spongy material of the plastic-foam-type can be used.

By these means it is prevented that during use of the belt the open spaces between the elements 6, 7 would be filled gradually with dirt or other particles by which the flexibility of the belt would decrease as well as the coefficient of friction as desired for the power transmission. In both cases this would decrease the efficiency of the transmission.

The stiffener members may be made of a special copper-aluminum alloy having high resistance qualities.

The depth of the cavities between the ribs of the profilation 12, 13 should preferably be larger than the thickness of the material of the friction pads 8, 9 above the tops of the profilation in order to limit the deformation of the covering layers and to obtain a favourable transmission of forces. The friction pads 5, 6 may comprise a material having higher wear resistance than that of the main molded body 4, 5 of the belt 1.

CLAIMS

1. A belt comprising a longitudinal pull strand of high tensile strength and a series of transversely extending longitudinally spaced stiffener elements presenting oppositely facing end surfaces angularly related to a cross-sectional plane of the said belt, the said pull strand being enclosed in a continuous flexible molded body of rubber type material running longitudinally through identical cavities of the said transverse elements which are connected to the said body, characterized in that the continuous body is molded in adherence with the transverse stiffener elements and connected thereto substantially by surface adherence.

2. A belt as claimed in claim 1 further characterized in that the said flexible continuous body is molded integrally with and in adherence

to the said pull strand as well as integrally with and in adherence to the said transverse elements as a sole interconnecting means extending between the said elements sidewardly at least onto their said oppositely-facing end surfaces and moreover adhering between the said tranverse elements to at least a portion of the side walls of the said elements along and beyond the edges of the cavities through which the said continuous molded body extends.

3. A belt as claimed in claim 1 or 2, further characterized in that the said pull strand is split up in two longitudinal sections in one plane each molded by the intermediary of a said continuous flexible body inside of two series of identical inwardly extending, opposite sideward slots provided in each of the said stiffener elements, thus shaping engaging surfaces on the upper and lower side of each slot.

4. A belt as claimed in any of the preceding claims, further characterized in that the said stiffener elements are metal plates spaced from each other at distances which are smaller than the thickness of the said elements.

5. A belt as claimed in any of the preceding claims, further characterized in that the mass of the said continuous flexible, molded body is sidewardly continued outside of the said oppositely facing end surfaces of the said stiffener elements in the shape of friction pads on the said surfaces.

6. A belt as claimed in any of the preceding claims, further characterized in that the spaces between the said stiffener elements above and below the said continuous, flexible molded body are stuffed with material which is more easily elastically compressible than that of the said molded body.

7. A belt as claimed in claim 6, further characterized in that the said spaces are filled up with a spongy material of the spongy plastic-foam-type.

8. A belt as claimed in any of the preceding claims, further characterized in that the mass of the said continuous flexible molded body is indented substantially onto the surface of the said pull strand in the middle plane between the parallel faces of each of two adjoining stiffener elements.

9. A belt as claimed in any of the preceding claims, further characterized in that the said transverse stiffener members are made of aluminum.

10. A belt as claimed in any of the preceding claims, further characterized in that surfaces of the stiffener elements onto which the material of the molded body adheres have a profilation, the cavities of the profilation being filled by the material of the molded body.

11. A belt as claimed in claim 9, further characterized in that the profilation has the shape of ribs having their longitudinal direction substantially at right angles to the plane of the stiffener elements so as to enable the shaping of these ribs in the operation of cutting the transverse elements from plate material by a corresponding shape of the cutter.

12. A belt as claimed in claim 5 and/or 11, further characterized in that the depth of the cavities of the profilation is larger than the thickness of the material of the friction pads on the oppositely facing end surfaces above the tops of the profilation.

13. A belt as claimed in claim 5 further characterized in that the friction pads comprise a material having higher wear resistance than that of the continuous molded body.

14. A belt as claimed in any of the preceding claims, further characterized in that the material of the continuous body is adhered to the contacting surfaces of the stiffener elements by vulcanisation of rubber.

15. A belt substantially as described with reference to any embodiment shown in the accompanying drawings.

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ABSTRACT:

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molded onto and with surface adherence both to the pull strand 2, 3 and to the transverse elements 4, 5. The belt body 4, 5 runs longitudinally through identical cavities 10, 11 of the transverse elements 6, 7, extending sidewardly
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<IMAGE>